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GIFT OF
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Cutting Power
of
Lathe Tools.

J. A. Freeland

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20 May '48 - Sec. 5 - Lesson 1.

As this is the age when every thing to be done in the engineering line must be done in the quickest, best and most economical manner possible and as lathe work is one of the most extensive operations in modern machine shops, a little investigation of lathe economy would undoubtedly be of value to the mechanical industry.

It is of course an object to get any particular piece of work done in the shortest time possible. In the roughing operation it is generally conceded that it is quicker to take a heavy cut at slower speed than vice versa

Until recently little attention

has been paid to the manner of taking a cut from a piece of material in the lathe, i.e. as to depth of cut & speed of tool & material. Lately, however, several experiments have been carried out in this line using larger tools & material.

The tool which takes the least power when it is new may rapidly deteriorate so that the cost of re-newal would bring the total for a given amount of work larger than when using a tool apparently not as good when new but which shows undoubtedly to have better wearing qualities.

The object sought after in the following tests was to find a tool which will do the work most economically. In order to have the results truly comparable, all the tools tested were ground to the same size and shape according to the standard roughing tool of Messrs. Wm Sellers Co. Phila. They had the following angles:

Owing to lack of time only two different grades of steel were tested viz. Capital and Jessop.

The apparatus used was a six foot, fourteen inch Sebring Lodge & Shipley lathe, using a tool one inch by one-half inch, a six horse power Crocker Wheeler shunt wound motor, a volt-meter and ammeter, a small Fairbanks scale, Prony brake and the tools & material to test.

The picture shows the arrangement of the lathe, motor etc.

B is the Prony brake which is fastened to the wheel W placed on the spindle S between the lathe centers. F is the Fairbanks scale and weights. The volt-meter V and ammeter A are placed as shown on a shelf back of the lathe.

V
A
B
S
W
F

The Test.

after having the apparatus properly set up and in good running order, the tests were started. The material cut was machine steel two inches diameter turned true and smooth and about sixteen inches long. This was weighed & placed in the lathe and the tool set in position. The tools were ground to be set perpendicular to the work and were so set. To have them perpendicular to the work, they were set in the holder and properly placed by the use of a square and pair of calipers.

Having the material and tool

properly set. the lathe was started and the time at which the tool began to cut was noted. The tool was allowed to travel a distance of one foot and the time taken noted. While the tool was cutting the reading of the voltmeter and ammeter was taken about every two minutes. also the speed of the material (RPM).

Table I shows the readings taken & the results obtained during and after the test.

After the tool had travelled the required distance, the material was removed and weighed and its condition & that of the tool & chip noted.

This test was repeated with each tool till it became dull or was destroyed.

RESULTS.

Having the weight of the machine steel before and after the cut was taken, the weight of metal removed is obtained by subtracting the latter from the former.

The speed of the material in feet per minute is obtained by multiplying its circumference in feet by the number of revolutions per minute.

To get the speed of the tool it is only necessary to divide the distance travelled in feet by the time in minutes taken

required to travel the distance, the result being feet per minute.

Knowing the diameter of the material before and after the cut, one-half their difference will give the depth of cut taken.

The time of cutting is the difference between the time of ending & time of starting the test. This is recorded in minutes.

The horse-power used in the test is obtained by multiplying the watts by the amperes & dividing by 746. This gives the total electrical horse-power used & includes all losses.

To eliminate all losses due to friction and in efficiency of motor

TABLE I.

Tool	Mat	Condt. Chip	Condt Mat	Condt. Tool	Cut Wet Dry	Time	Speed Mat	Speed Tool	Elec. H.P.	Tool H.P.	Depth Cut	Wt Rem'd	Ft. Lbs Rem'd 1 Lb.	Diam Mat.	Width Cut
J_1	MCH. STEEL	SHORT CURLY	ROUGH TORN	EDGE DES'D.	WET OIL	22.4'	9.4	.0447	1.01	.174	.172	1.78	3240	$1\frac{39}{64}$	.24
J_2	"	GRNLR	ROUGH	GOOD	DRY	20.75	11	.0482	.951	.134	.156	2.43	1820	$1\frac{53}{64}$	.251
"	"	"	ROUGH	BRKN PT.	"	17.8	11	.0495	.98	.153	.156	2.2	2300	$1\frac{53}{64}$	.261
"	"	"	"	DUL'D	"	19.6	17.26	.0511	1.2	.339	.172	2.65	4390	$1\frac{25}{32}$	.163
"	"	"	"	"	"	1968	17.	.0508	1.22	.373	.156	2.77	4460	$1\frac{53}{64}$	.172
"	"	"	"	SAME	"	14.77	17.8	.0676	1.23	.398	.133	2.43	5410	$1\frac{59}{64}$	.23
J_3	"	"	SM'TH	GOOD	"	22.2	11.7	.0444	1.08	.225	.156	2.88	2580	$1\frac{15}{16}$	.23
"	"	"	"	DUL'D	"	18.07	16.95	.0552	1.2	.339	.196	3.06	3660	$1\frac{47}{64}$	.176
"	"	" CURLY	"	"	"	19.06	17.65	.0525	1.16	.294	.133	1.74	5570	$1\frac{59}{64}$	.178
"	"	"	"	"	"	16.27	14.9	.0614	1.18	.315	.211	2.25	4620	$1\frac{5}{8}$	.211
C_1	"	GRNLR	ROUGH	GOOD	WET OIL	19	7.95	.0526	.984	.151	.164	1.79	2790	$1\frac{?}{32}$	.263
"	"	"	"	"	DRY	20.6	11.4	.0497	1.045	.198	.133	2.61	2510	$1\frac{57}{64}$	.26
"	"	CURLY	SM'TH	"	"	17.55	17.2	.0569	1.15	.284	.133	2.42	3870	$1\frac{53}{64}$	.19
"	"	GRNLR	"	DUL'D	"	14.48	13.1	.0691	1.11	.249	.0782	1.35	6100	$1\frac{9}{32}$	.213
C_2	"	CURLY	ROUGH	"	"	20.3	9.91	.0493	.913	.108	.0937	.925	3860	$1\frac{37}{64}$	.249
"	"	GRNLR	SM'TH	"	"	16	14.6	.0625	1.15	.284	.0703	2.2	4270	$1\frac{21}{32}$	.224
C_3	"	CURLY	"	GOOD	"	20.12	17.3	.0498	1.19	.33	.125	2.41	4530	$1\frac{55}{64}$	.173
"	"	GRNLR	"	DUL'D	"	17.2	17.45	.0581	1.19	.33	.133	2.07	5150	$1\frac{43}{64}$	.175

a Prony brake was used on a small wheel placed between the lathe centres and the power obtained on the brake was taken so that used by the tool when using the same volts and amperes.

From these results a curve can be drawn showing the relation between the total electrical horse-power used and that used by the tool.

See FIG. I.

From this curve we can get the horse-power taken by each tool for each cut as follows: The ordinates are electrical horsepower (total) used. the abcissae being horse power obtained from the brake.

Knowing the total electrical horse power taken by each tool we draw from the ordinate an abcissa till it strikes the curve, the reading of the curve at this point being the horse-power for the given tool. These results were tabulated with the other data in table I

Curves can also be drawn for each tool used with foot pounds to remove one pound of material as ordinates and total weight of material removed as abcissae. From these curves comparisons can be made as to which tool deteriorates the fastest. See FIG.

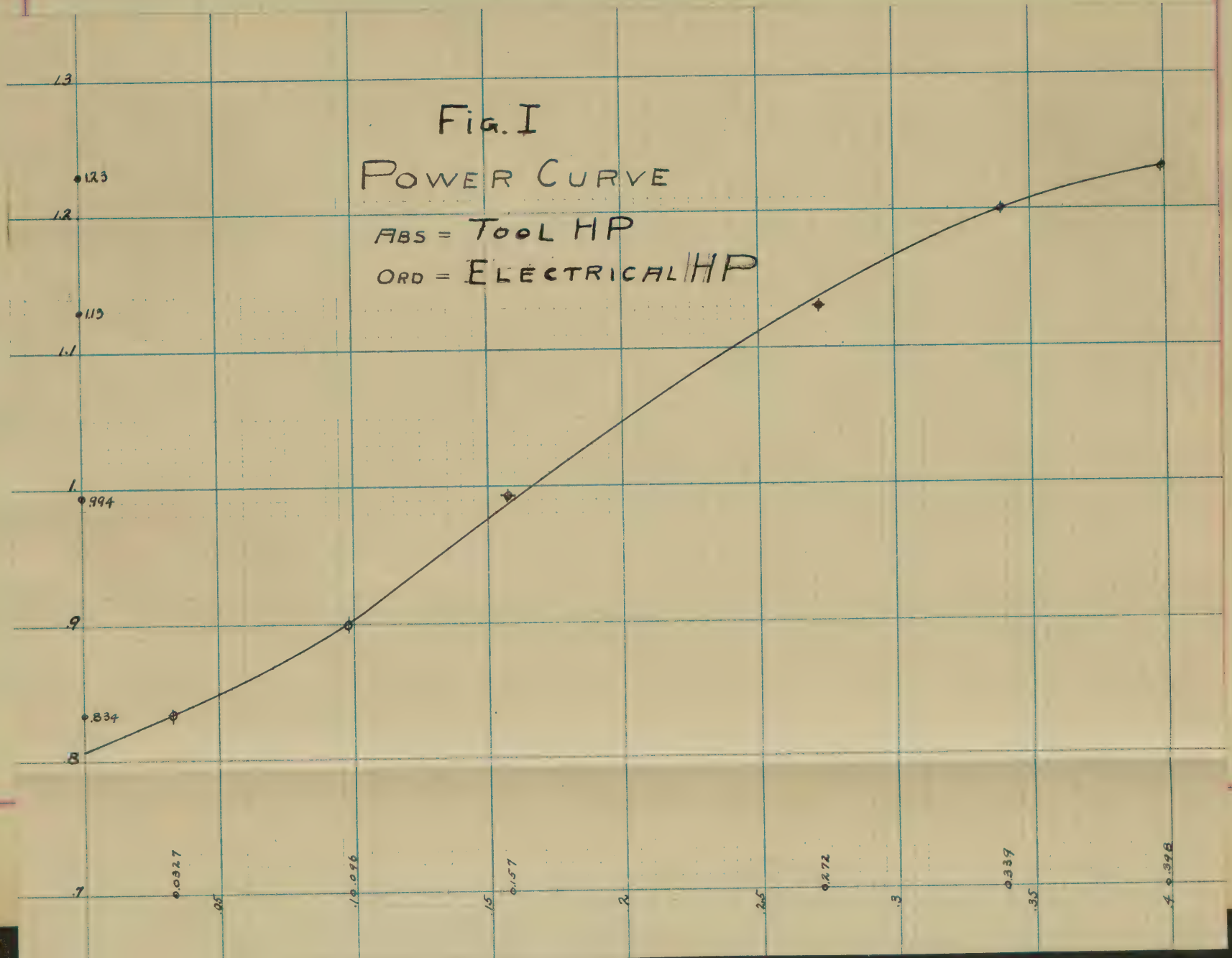

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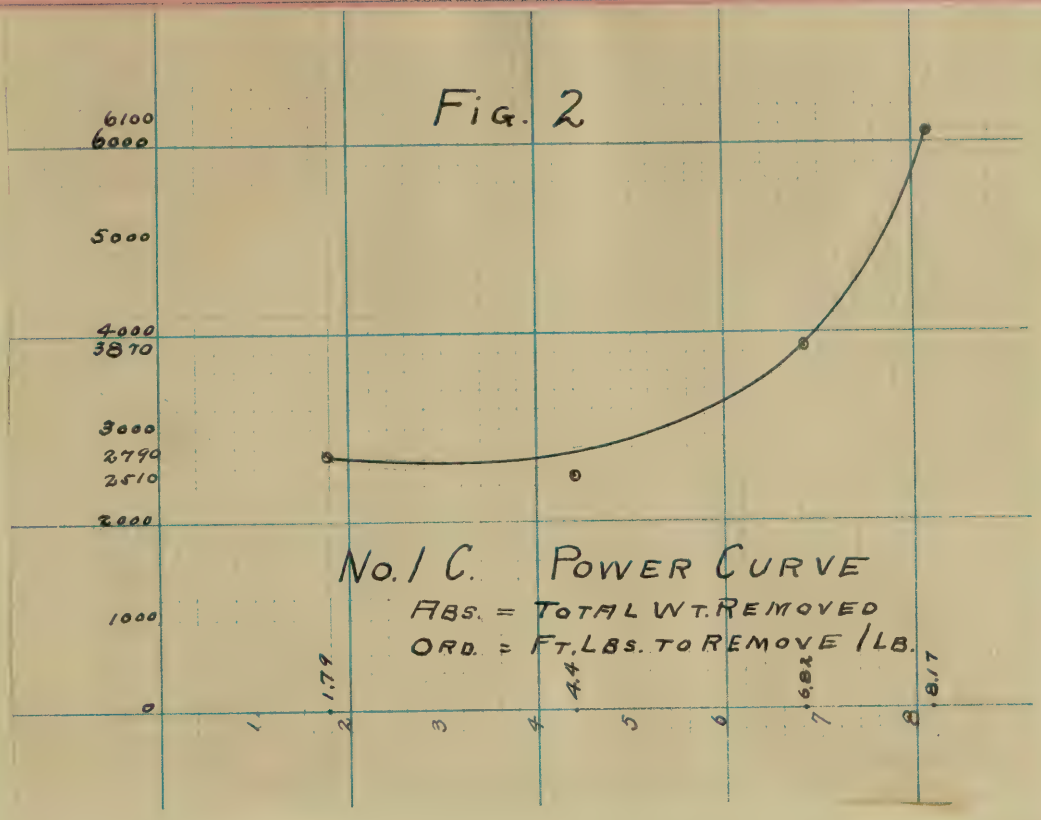
Fig. 2



No. 1 C. Power Curve

Abs. = Total Wt. Removed

Ord. = Ft. Lbs. to Remove 1 Lb.

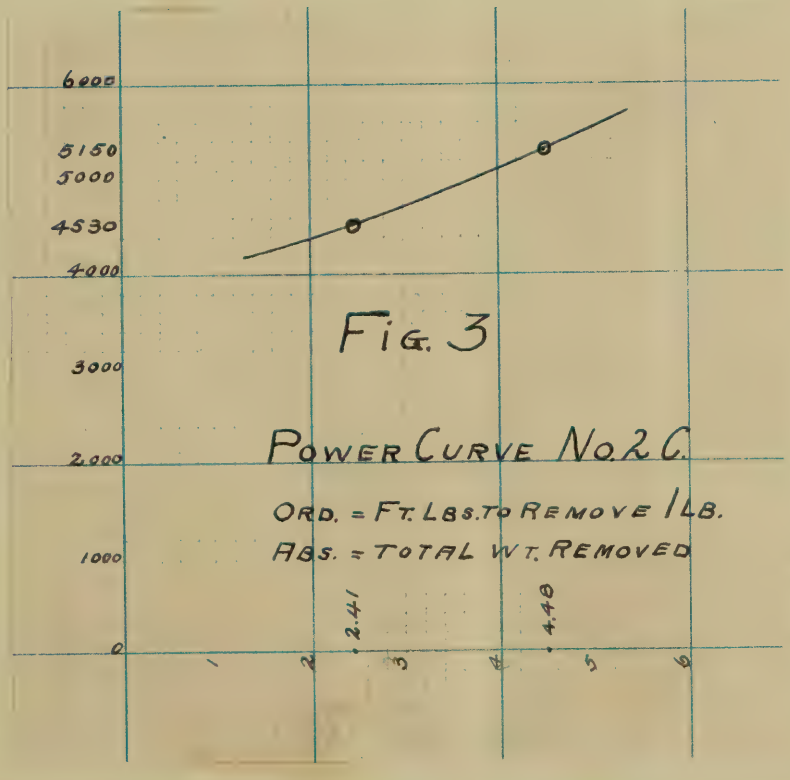


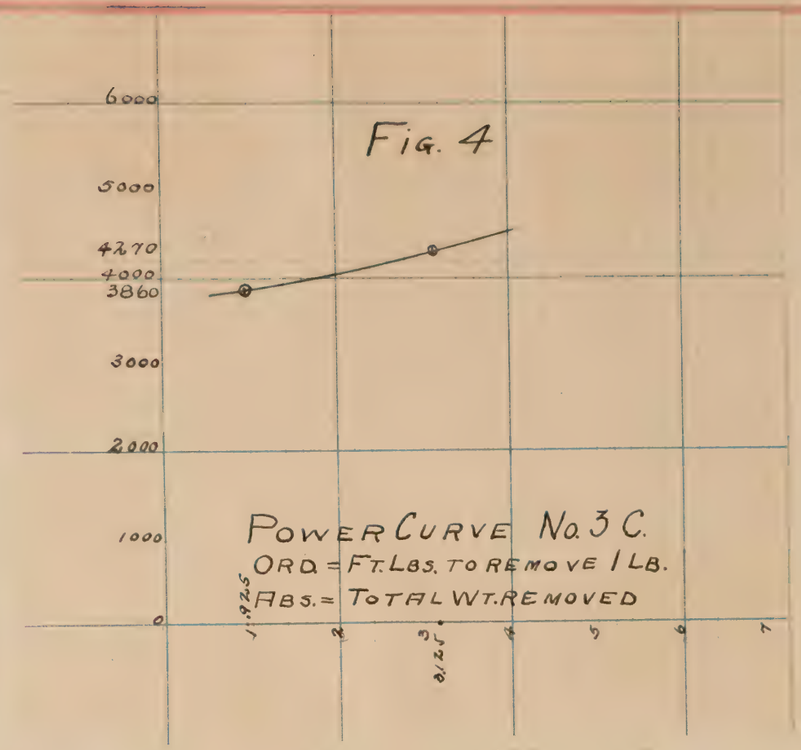
Fig. 3

Power Curve No. 2 C.

Ord. = Ft. Lbs. to Remove 1 Lb.

Abs. = Total Wt. Removed

Fig. 4



POWER CURVE No. 3 C.
ORD = FT. LBS. TO REMOVE 1 LB.
ABS. = TOTAL WT. REMOVED

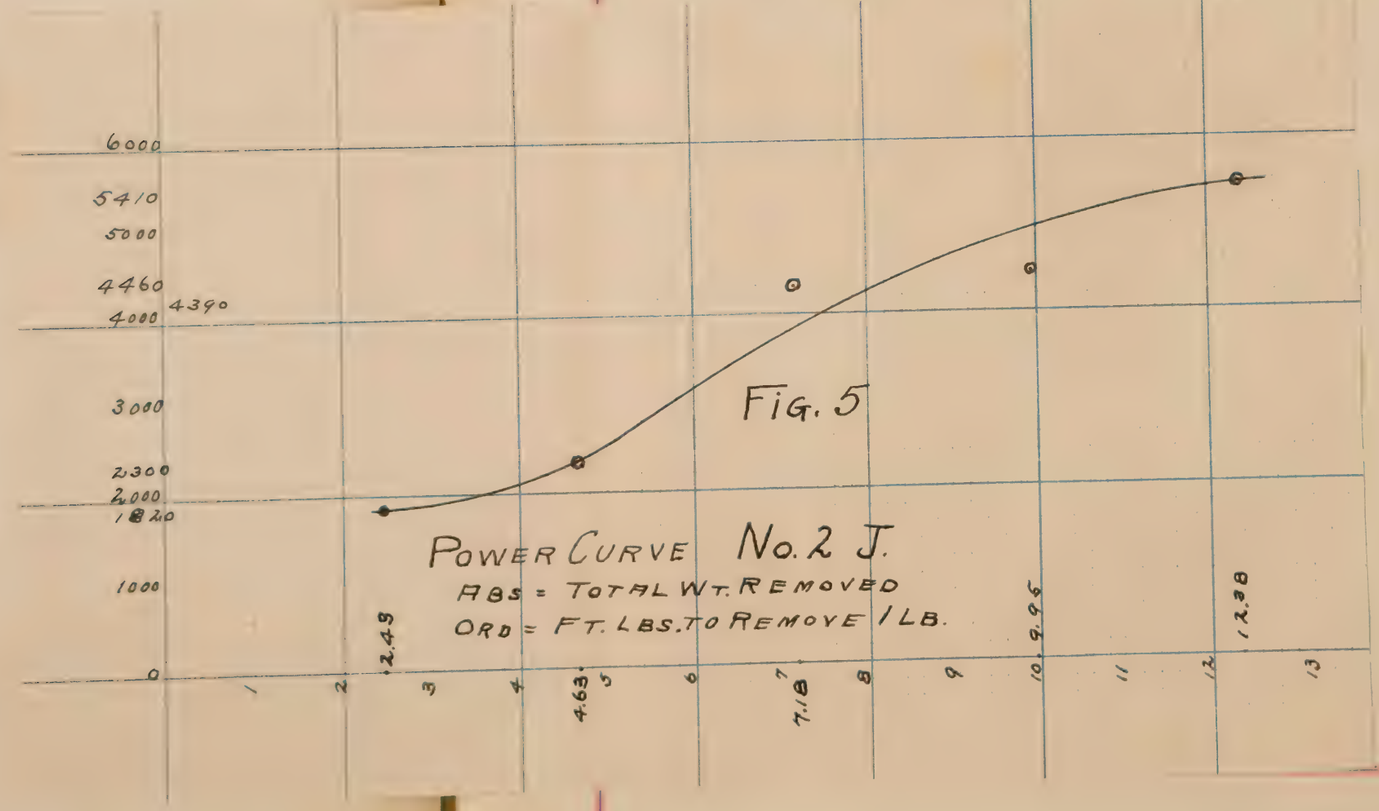


Fig. 5

POWER CURVE No. 2 J.
ABS = TOTAL WT. REMOVED
ORD = FT. LBS. TO REMOVE 1 LB.

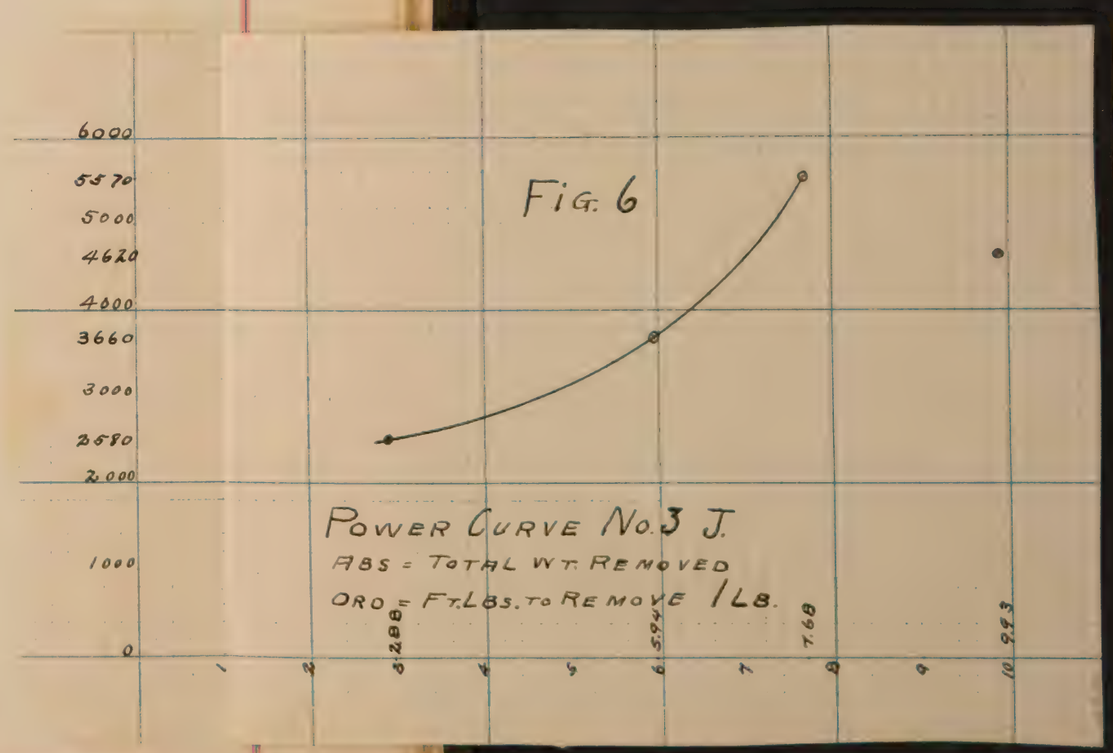


Fig. 6

POWER CURVE No. 3 J.
ABS = TOTAL WT. REMOVED
ORD = FT. LBS. TO REMOVE 1 LB.

From the importance of the subject & the results obtained in the foregoing tests, it seems profitable to carry out more experiments along the same lines, at the same time noting the best speed of the tool in relation to the speed of material and depth of cut.

The results obtained show which tool stood the work best i.e. removed the most material for the least deterioration. The material removed by the Jessop tools before becoming dulled or destroyed was 24.09 pounds. That removed by the capital tools 15.78 pounds. The conclusions shown by these results cannot of course be

taken as an absolute com-
parision of the merits of the two
steels on account of the
small number of tests made.

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